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United States Department of Agriculture,

BUREAU OF PLANT INDUSTRY,

Seed and Plant Introduction and Distribution,

WASHINGTON, D. C.

RIVERS SEA ISLAND COTTON.

HISTORY.

The Rivers Sea Island cotton is a variety resistant to the disease known as wilt or "black-root," and is now distributed for the second time by the Department of Agriculture. It was originated in connection with investigations made by this Department at James Island, S. C., in cooperation with Mr. E. L. Rivers. The cotton wilt became troublesome there about 1892 and had caused much loss and excited considerable apprehension among the planters, when in 1895 and again in 1899 and succeeding years it was studied by the pathologists of this Department. Experiments with fertilizers, fungicides, and rotation of crops had resulted in failure, and it was feared at one time that cotton culture might have to be abandoned. The effort to produce a resistant variety was based on the observation that some plants remained healthy even in the worst infected places, and it was thought that the seed from such stalks might produce other resistant plants. Mr. Rivers in 1899 saved the seed from a single plant which had survived the disease, while all surrounding plants had been killed. This was planted in 1900 in a single row through a field badly infected with the wilt disease. The result was that in this row not a single plant died, while the adjoining rows planted with ordinary seed were almost totally destroyed.

Sufficient seed was obtained from this row to plant an acre the next year (1901). This land was also infected with the cotton wilt, but only two or three plants became affected, showing the great resistance of the new variety. In 1902 fifteen acres were planted. This land was badly infected with wilt, and previous crops had been nearly destroyed in portions of the field, so that the land had been abandoned for cotton. The Rivers cotton proved as resistant here as in the previous years. An occasional plant became diseased and was pulled up, but the field as a whole was perfectly healthy and produced a large crop.

In 1903 this strain was planted again on the field used in 1900, which was as badly infected as any land could be. (See Pl. I, fig. 1, an illustration showing almost complete destruction of the cotton in 1900.) The great resistance of the new variety is shown in Plate I, fig. 2, an illustration of the same field in 1903 when planted with the Rivers cotton. A few rows of another variety near by were almost wholly killed by wilt, but very few cases appeared in the Rivers field, and an exceptionally large crop was obtained in spite of unfavorable weather conditions. The grade of staple was also improved.

A more extended test was made by sending several hundred packages through the Congressional seed distribution to Georgia and Florida. The season there was very unfavorable, with alternating floods and drought, and a fair test was impossible, but the majority of the reports received was favorable. The resistance to wilt was maintained, though there seemed to be a slightly larger proportion of plants succumbing to wilt than on the Sea Islands. Experience has shown that the varieties of coarser or medium staple are hardier and better suited to the conditions in the interior than the fine varieties. The Rivers belongs to the latter class, and in other respects than its wilt resistance may be expected to show a more delicate constitution when subjected to poor culture or unfavorable soil and weather conditions. It is not more resistant than the common varieties to other diseases that sometimes attack Sea Island cotton, such as rust, anthracnose, or root-knot. It has nevertheless proved to be the best variety available for land infected with the wilt fungus, and by its success the fact has been demonstrated that the cotton wilt can be overcome by the use of resistant varieties. Other strains are now being bred for future distribution with the aim of securing greater hardiness and productiveness with special adaptation to Georgia and Florida conditions.

The general characters of the Rivers cotton are indicated in the following description:

Plant resistant to wilt, vigorous, compact, pyramidal, branching near the base; limbs small, smooth, close-jointed, reddish-green; leaves medium size, deep-lobed; bolls medium size, 1 inch by 2 inches, long and pointed, three to four lobed; seed small, black, well covered; per cent of lint, 28; staple 2 inches long, cream white, fully to extra fine; season medium early.

DIRECTIONS FOR PLANTING.

Since only a small quantity of seed can be had, unusual care ought to be taken in planting to make it go as far as possible. One acre can be planted with a peck of seed by dropping by hand three seeds in a hill. Cover lightly and thin out to one in a place.

Distance.—In land of ordinary fertility plant in rows 4 feet apart, with the plants 18 inches apart in the row. In rich soil make the rows 5 feet apart, with 20 to 22 inches between the plants.

To fully test the resistant qualities of the Rivers cotton, this seed



FIG. 1.—FIELD OF SEA ISLAND COTTON DESTROYED BY WILT WHEN PLANTED WITH ORDINARY SEED, JAMES ISLAND, S. C., 1900.



FIG. 2.—THE SAME FIELD PLANTED WITH RIVERS COTTON IN 1903. ENTIRELY RESISTANT TO WILT.

should, if possible, be planted on land where cotton has in previous years suffered badly from wilt (black-root). This variety is one of the finer sorts of Sea Island cotton and requires favorable surroundings for its best development. Its superior quality and productiveness will repay the extra outlay. It does best on well-drained sandy loam of good fertility; and if it is desired to give it a fair test, such a field should be selected. It will not do as well on low, wet land; neither will it thrive when the preparation and cultivation of the land are neglected. To secure the best results, therefore, plow deep, prepare the land thoroughly, and use 400 to 600 pounds per acre of commercial fertilizer or its equivalent in stable manure or compost. Cultivate well and frequently. On the Sea Islands the cotton is grown on high beds and the soil drawn up around the plants in cultivating. Level culture is recommended for Georgia and Florida, however, except on poorly drained land.

DESCRIPTION OF COTTON WILT.

The especial feature of this variety is its resistance to the wilt, and since some who receive the seed may not be familiar with that disease, a brief description of it is included here. For more detailed information write to the Department of Agriculture at Washington for Bulletin 27 of the Division of Vegetable Physiology and Pathology.

The wilt disease is also known as "blight" and "black-root." It is injurious to Sea Island cotton on the Sea Islands of South Carolina, and in southern Georgia and in Florida, and to Upland cotton over wide areas in several States. It is worse on sandy soils, where it persists year after year. Prominent symptoms are the wilting of the plants, which are dwarfed or killed, the brown discoloration of the inner wood of stem and root, and a tufting of the small rootlets.

The wilt is caused by a parasitic fungus (*Neocosmospora vasinfecta* Erw. Sm.) in the soil, which enters the roots and grows upward through the water-carrying vessels of the stems, which it clogs. It is aggravated by continuous cropping in cotton, but can not be remedied by rest or rotation, since the fungus can live in the soil for an indefinite time after it has once obtained a foothold. It is not due to the poverty of the land nor to the use of commercial fertilizers, and can not so far as known be cured by adding any fertilizer or other substance to the soil.

CONTROL.

The only remedy is the use of resistant varieties. Since the fungus does not attack any other crop except okra, when land is badly affected by wilt and seed of resistant cotton can not be had some other crop than cotton should be planted.

Although a rotation of crops will not entirely rid land of the cotton wilt after it has become badly infected, the practice should be strongly

urged in connection with the use of resistant varieties, as a suitable rotation will do much to prevent the wilt disease from becoming established in any land. Most southern soils are deficient in vegetable matter, and this condition is aggravated by continuous cotton growing, the effect on the plant being seen in the decreased yield and greater tendency to rust. The planting of legumes, such as cowpeas, velvet beans, ground peas, soy beans, beggarweed, crimson clover, hairy vetch, etc., corrects this trouble by the addition of vegetable matter to the soil, while at the same time they draw nitrogen from the air and lessen the need for commercial fertilizers. A rotation should also provide for a winter cover crop to prevent loss of plant food by washing and leaching. The best succession of crops must be determined by the individual farmer, but the following is suggested: (1) Corn with cowpeas; (2) oats, followed by cowpeas; (3) cotton. Other combinations of legumes that may be used in rotation with cotton are (1) corn with ground peas; (2) beggarweed, cut twice for hay; (3) oats with hairy vetch, pastured in the winter and cut for hay in the spring; (4) sorghum and cowpeas together; (5) soy beans; (6) oats, cut early, and followed by velvet beans; or (7) crimson clover sowed in cotton or corn in the fall.^a

ROOT-KNOT.

An important point to consider in planning rotations is the presence of root-knot, a disease which often occurs associated with wilt on sandy soils. The cause is a minute worm or nematode (*Heterodera radicicola*) that produces irregular swellings or galls on the roots of cotton, cowpeas, peaches, and many vegetables. Where this occurs all crops subject to its attack must be avoided. The common cowpea is very susceptible to it, and when planted on infected land harbors and propagates the nematode to such an extent that following crops of cotton, etc., are greatly damaged. The cultivation of cowpeas may thus be a decided injury to land instead of a benefit. One variety, the Iron, distributed by this Department, is practically immune to root-knot and may be used with safety. Oats is an excellent crop to starve out the nematodes, and may be followed by velvet beans, beggarweed, or corn.^b

The Rivers cotton should not be planted on land infected by root-knot until after two years' rotation with immune crops.

ANTHRACNOSE.

This disease, caused by the fungus *Colletotrichum gossypii*, has been epidemic in the Sea Island region during the past two years and was by some confused with wilt. It attacks the bolls and the limbs, causing

^a For information in regard to these crops write to the Secretary of Agriculture, Washington, D. C., for Farmers' Bulletins Nos. 58, 81, 89, 98, 102, and 147.

^b For further information on root-knot and the Iron cowpea, write for Bulletin 17 of the Bureau of Plant Industry.

the former to decay and the latter to shed their fruit and sometimes break off, while wilt attacks the root and is indicated by the blackening of the inside wood. The Rivers cotton is probably not more resistant to anthracnose than the common varieties. No good remedy is known for anthracnose, but investigations on this point are in progress by this Department.

PICKING AND HANDLING.

It is rare that sufficient care is given to the picking and handling of the Sea Island cotton grown in the interior. The highest market price can not be obtained unless the cotton is free from trash and dirt. The points most important to observe are: (1) Pick often to avoid injury by the weather; (2) sun the cotton on a low arbor after picking to dry it; (3) sort out all trash, yellow and immature cotton, etc., before ginning, as all these impurities injure the sale of the lint. On the Sea Islands the handling of the cotton is thoroughly systematized as follows: First, when the cotton is brought from the field the pickers sort it over to remove bits of leaves and bolls and all yellow and immature locks, as these latter have a weak staple and can not be used by the spinners. Then, after the cotton is sunned on an arbor, experienced hands overhaul it again on frames covered with wire netting to remove dirt and inferior cotton. After ginning, as the lint leaves the gin it is "moted" and sorted again by two sets of hands to insure the removal of all impurities and to make the quality more uniform before baling.

If your trial of this variety results satisfactorily, save all the seed carefully, as it will be difficult to obtain more from any source. In ginning this seed care should be taken to avoid mixing with inferior cotton. Have the gins cleaned out before beginning, and catch the seeds as they come from the gin without allowing them to run through the conveyors or fall on the common pile.

SELECTION OF SEED TO MAINTAIN QUALITY.

The qualities of resistance, bearing, etc., characteristic of this cotton will be found to be thoroughly fixed in the seed distributed. It can not be expected that they will be maintained indefinitely, however, unless careful annual selection of seed is practiced. Though the variety is highly resistant to wilt, there will be occasional individuals reverting to the original type and becoming attacked by the disease. All such should be weeded out and destroyed.

To keep this seed pure it is important that it should not be planted near the short-staple Upland cotton, as the two species mix by pollen carried from flower to flower by bees. The result of such hybridization is the tall barren stalks frequently seen in Sea Island fields.

These are not only worthless, but injurious, as they crowd out good plants and lead to further contamination of the seed. They should therefore be destroyed whenever found. Much of the "running out" of the long-staple cotton in south Georgia is due to accidental hybridization with neighboring fields of short-staple cotton. A distance of one-quarter of a mile between fields is advised if it is desired to prevent crossing with other varieties.

To keep up the quality of this variety the adoption of a system of selection of seed from the best plants is recommended. This is easily done by either of the two methods described below.

1. Before picking, go over the field carefully and mark with a cloth the plants that are true to the type of the variety as regards form of plant, size, and form of bolls, productiveness, earliness, etc., with the lint long and fine and seeds well covered. (See Pl. II, fig. 1, showing typical bolls of the Rivers cotton, and fig. 2, showing an average type of plant.) Let these plants be picked separately and the seed ginned by itself. If not enough seed is obtained to plant the whole crop, use it to plant a special seed patch that will furnish seed for the main crop the next year.

2. A better method, involving only a little more trouble, is to select from the general field a few plants of the greatest excellence, marking them with a cloth. Leave these unpicked till the middle of the season, then compare them critically with reference to bearing, length, and quality of staple, resistance to wilt, etc., and *choose from this number a single plant which combines the most desirable qualities.* Save all the seed carefully and plant separate from the main crop the next year, one seed in a hill, to secure as great a yield as possible. This cotton planted by itself each time will give sufficient seed the third year to plant the whole crop. This selection should be carried out every year. The propagation from single plants insures a uniformity that can be secured in no other way. This is the method practiced in the Sea Islands, and if it were done in Georgia and Florida there would be less trouble with the "running out" of the cotton.

For a full account of methods of seed selection, read the article on "Improvement of Cotton by Seed Selection," by H. J. Webber, in the Yearbook of the U. S. Department of Agriculture for 1902. This article will be sent free on request.

W. A. ORTON,
Pathologist.

Approved:

A. F. WOODS,
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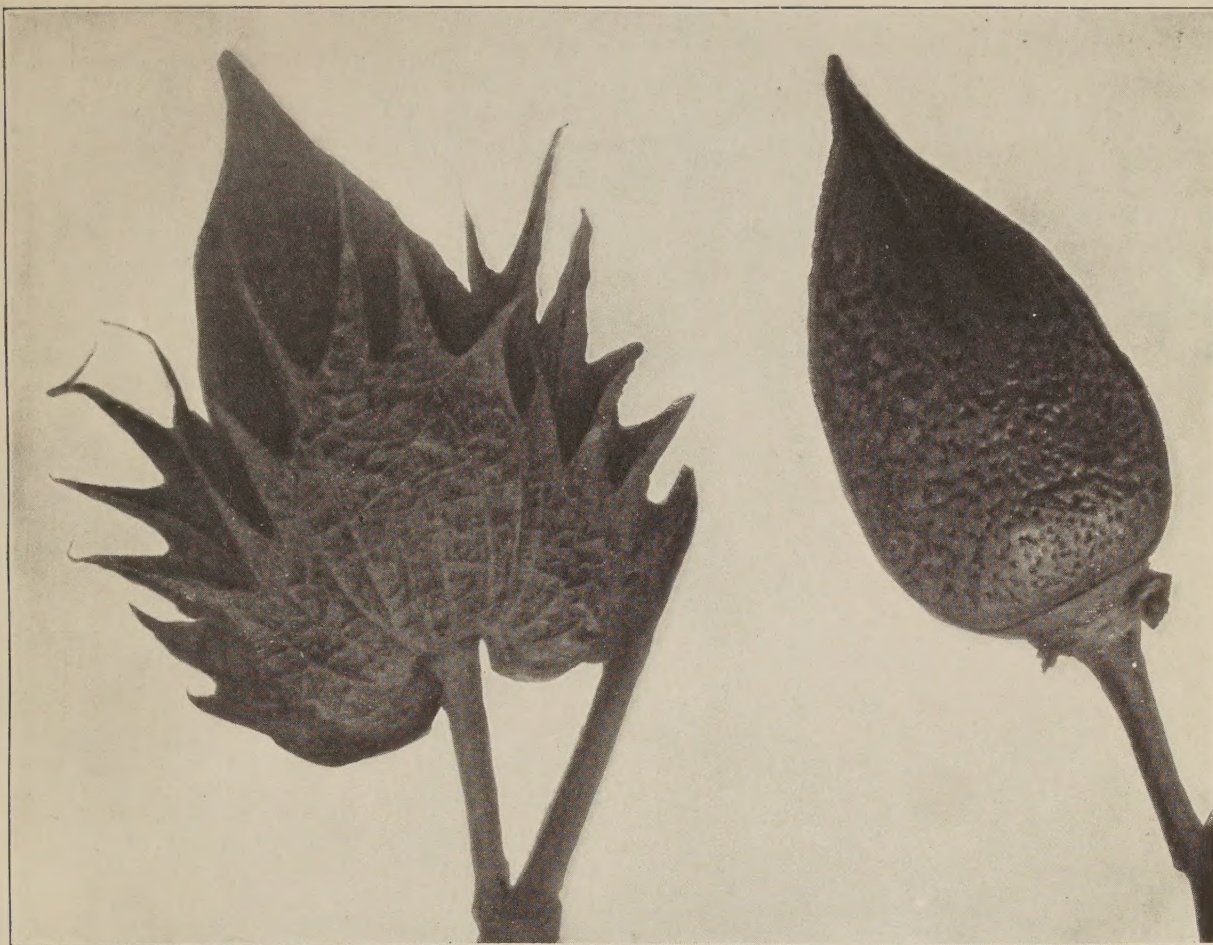


FIG. 1.—BOLLS OF RIVERS SEA ISLAND COTTON (NATURAL SIZE).



FIG. 2.—AVERAGE PLANT OF RIVERS SEA ISLAND COTTON.



REPORT OF RESULTS DESIRED.

The Department of Agriculture will continue the work of originating and distributing wilt-resistant varieties adapted to the requirements of the various cotton-producing sections, and the active cooperation of farmers will be of great assistance. It is desired to know the results of all trials of the Rivers cotton, and every farmer who receives seed is requested to return the accompanying card with his name and address, signifying his willingness to report at the end of the season. Blanks will then be sent out to be filled and returned. The information asked in this report will cover the following points:

Character of soil, and whether or not infected with wilt and root-knot.

Character of season, size of field planted, and total yield of seed cotton as determined by actual weight.

Yield of lint, determined by weight after ginning.

Value of the variety for your section as compared with the kinds commonly grown.

A. J. PIETERS,
Botanist in Charge.

Approved:

B. T. GALLOWAY,
Chief of Bureau.

DECEMBER 30, 1903.

